Artificial Intelligence Homework 2
Multiagent

2015 / 11 / 19

Question 1 – Reflex Agent

- Given a game state, a reflex agent chooses the action that leads to the highest value of evaluation function.
- getAction(self, gameState)

```
# Collect legal moves and successor states
legalMoves = gameState.getLegalActions()
# Choose one of the best actions
scores = [self.evaluationFunction(gameState, action) for action in legalMoves]
bestScore = max(scores)
bestIndices = [index for index in range(len(scores)) if scores[index] == bestScore]
chosenIndex = random.choice(bestIndices) # Pick randomly among the best
return legalMoves[chosenIndex]
```

- evaluationFunction(self, currentGameState, action)

Question 1 – Reflex Agent

- Given a game state, a reflex agent chooses the action that leads to the highest value of evaluation function.
- getAction(self, gameState)
- evaluationFunction(self, currentGameState, action)

```
successorGameState = currentGameState.generatePacmanSuccessor(action)
newPos = successorGameState.getPacmanPosition()
oldFood = currentGameState.getFood()
newGhostStates = successorGameState.getGhostStates()
newScaredTimes = [ghostState.scaredTimer for ghostState in newGhostStates]
return successorGameState.getScore()
```

  - Hints: Go to the nearest food, eat the capsule then go chasing the ghosts.

Question 2 – Minimax Agent

- Given a game state, a reflex agent chooses the action that leads to the highest value of evaluation function.
- getAction(self, gameState)

  legalMoves = gameState.getLegalActions() only consider the legal moves of the Pacman

  _____ remove action "stop" from legal moves

  numOfAgents = gameState.getNumAgents() the total number of agents in the game

  _____ new game states result from every legal moves of Pacman

  scores = [self.evaluationFunction(gameState, action) for action in legalMoves] the "game value" of new game states evaluated by self.minimax

  bestScore = max(scores)

  bestIndices = [index for index in range(len(scores)) if scores[index] == bestScore]

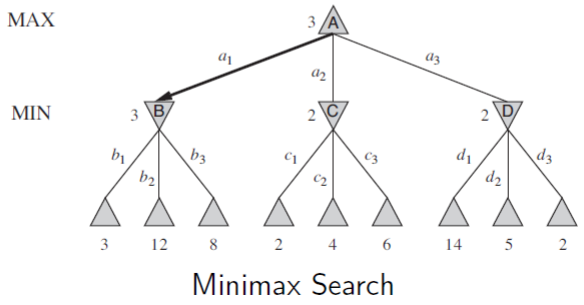
  chosenIndex = random.choice(bestIndices) # Pick randomly among the best

  return legalMoves[chosenIndex]

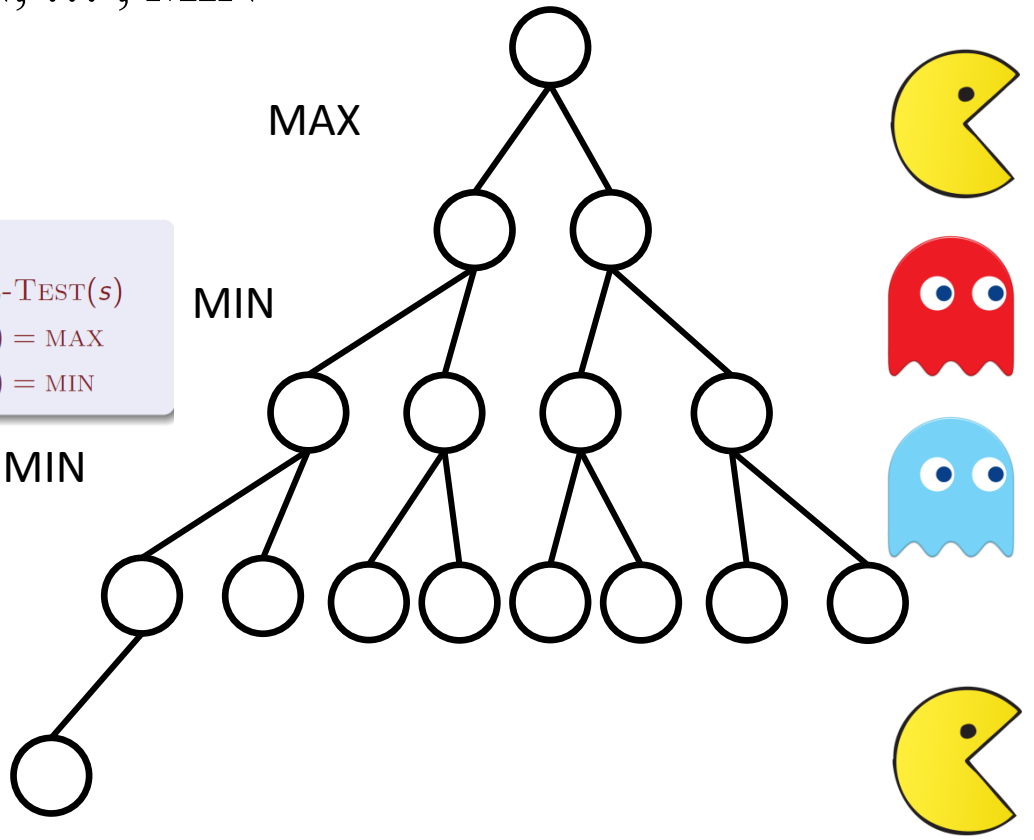
Question 2 – Minimax Agent

- minimax(self, gameState, depth, agentIndex)
  - 1 depth: MAX, MIN, MIN, … , MIN
  - recursive call
  - 10 lines only

$$\textsc{Minimax}(s) = \begin{cases} \textsc{Utility}(s) & \text{if } \textsc{Terminal-Test}(s) \\ \max_{a \in Actions(s)} \textsc{Minimax}(\textsc{Result}(s,a)) & \text{if } \textsc{Player}(s) = \textsc{max} \\ \min_{a \in Actions(s)} \textsc{Minimax}(\textsc{Result}(s,a)) & \text{if } \textsc{Player}(s) = \textsc{min} \end{cases}$$



Minimax Search



Question 3 – Alpha Beta Agent

- getAction(self, gameState)
  - nearly the same as minimax agent
- alphabeta(self, gameState, depth, agentIndex, alpha, beta)

Question 4 – Expected Minimax Agent

- getAction(self, gameState)
  - nearly the same as minimax agent
- expectiMinimax(self, gameState, depth, agentIndex)
  - nearly the same as minimax agent, except…
  - The ghosts don’t return the min of all game values, they return the average of them.

Question 5 – Better Evaluation Function

- Originally, the evaluation is based on the score of the given state.
- Try to “eat” the ghost four times in the game!
- This evaluation function is different from the one of Question 1 in that here the evaluation is only a function of game state, where as in Question 1 the evaluation is a function of game state and action.
- Remember to write your documentation!

Additional

- Please
- Use .zip file (no .rar or anything else)
- Verify your uploaded file by downloading it on ceiba
- Check the deadline carefully
- For Mac users, you can read this article:
  - http://wpguru.co.uk/2013/10/how-to-remove-__macosx-from-zip-archives/
  - (I'm not a Mac user so not sure if this works)